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# Observable restrictions of general equilibrium models with financial markets

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## Abstract

This paper examines whether general equilibrium models of exchange economies with incomplete financial markets impose restrictions on prices of commodities and assets given the stochastic processes of dividends and aggregate endowments. We show that the assumption of time-separable expected utility implies restriction on the cross-section of asset prices as well as on spot commodity prices. However, a relaxation of the assumption of time separability will generally destroy these restriction.

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## 1. Introduction

General equilibrium theory as an intellectual underpinning for various fields in economics is often criticized for its lack of empirical content (see for example [10]). While Brown and Matzkin [3] challenge this view by showing that there are restrictions on the equilibrium correspondence, i.e. the map from individual endowments to equilibrium prices, it is now well understood that these restrictions only arise because *individual incomes* are observable and that general equilibrium theory imposes few restrictions on aggregate quantities and prices alone. There are no restrictions on the equilibrium set [19] and there are no restrictions on the equilibrium correspondence when individual incomes are not observable and when

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the number of agents is sufficiently large (see, e.g., [4] for a local analysis, but see also positive results in [21]).

However, in models with time and uncertainty there are various natural assumptions on individual preferences which ensure that equilibrium prices cannot be arbitrary for given aggregate endowments. When agents consume after uncertainty about endowments is resolved, it is often assumed that they have von Neumann–Morgenstern utility with common beliefs. It is well known since Borch [2] that for this case, Pareto-optimality implies that agents' optimal consumptions are a non-decreasing function of aggregate resources only. With complete financial markets competitive equilibria are Pareto-optimal and possible equilibrium prices for state contingent consumption must therefore be anti co-monotone to aggregate endowments (see e.g. [15] or [7] for a detailed analysis of this case). There exist restrictions on the equilibrium set for fixed aggregate endowments under the assumption that markets are complete and agents maximize expected utility with homogeneous beliefs.

In this paper, we take this observation as a starting point and examine how it generalizes to economies with multiple commodities per state, incomplete financial markets, heterogeneous beliefs and several time periods.

Independently of complete financial markets and Pareto-optimality of competitive equilibrium allocations the assumption of expected utility with homogeneous beliefs turns out to impose joint restrictions on aggregate variables and cross-sectional asset prices.

In a multi-period model, when households maximize time-separable expected utility, restrictions from a two period model translate immediately to restrictions at each node of the event tree. When agents' expectations are unknown and heterogeneous there are restrictions on asset prices, dividends and aggregate endowments as long as beliefs are restricted to lie in some strict subset of possible beliefs, i.e. subjective probabilities are bounded away from zero.

In the light of the theoretical literature on equilibrium restrictions these results are not necessarily surprising because time-separable expected utility is a very strong assumption. However, under this strong assumptions, our results show that there are restrictions on the equilibrium set—individual endowments are not observed (as for example in [3]) but equilibrium prices are restricted for given aggregate endowments. It is natural to ask whether this is a property specific to time-separable expected utility. We show that a slight relaxation of time separability is likely to destroy all these restrictions. In particular, a model where agents maximize recursive utility imposes almost no restrictions on aggregate data, even under fairly strong additional assumptions on the aggregator which ensure that individual choices in spot markets have to satisfy the strong axiom of revealed preferences.

The paper is organized as follows. In Section 2 we give a short introduction into the model and we define formally what we mean by 'restrictions'. In Section 3 we examine restrictions on the joint process of asset prices, spot prices and aggregate endowments under the assumption of time-separable expected utility. In Section 4 we argue that time-separability of the utility functions is crucial for these results.

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